

WE CLAIM:

1. A voltage regulated transistor driver in a system further employing a
5 voltage source and at least one transistor, said voltage regulated transistor driver comprising:
 - a variable voltage multiplier operable to generate a regulated driver voltage for driving the at least one transistor,
 - wherein, in a voltage multiplier mode, the regulated driver voltage
10 is greater than a source voltage electrically communicated to said voltage regulated transistor driver by the voltage source, and
 - wherein, in a voltage follower mode, the regulated driver voltage approaches the source voltage to thereby equal or approximate the source voltage; and
 - a voltage multiplier controller operable to electrically communicate a
15 multiplier control voltage to said variable voltage multiplier,
 - wherein the driver control voltage is indicative of a selection of one of the voltage multiplier mode and the voltage follower mode to thereby set said variable voltage multiplier in one of the voltage multiplier mode and the voltage follower mode.
 - 20 2. The voltage regulated transistor driver of claim 1, wherein the multiplier control voltage indicates a selection of the voltage multiplier mode in response to the source voltage being less than a high voltage threshold.
 - 25 3. The voltage regulated transistor driver of claim 2, wherein the multiplier control voltage indicates a selection of a fixed version of the voltage multiplier mode in response to the regulated driver voltage being less than a low voltage threshold.

4. The voltage regulated transistor driver of claim 2, wherein the multiplier control voltage indicates a selection of a varying version of the voltage multiplier mode in response to the regulated driver voltage being greater than a low voltage threshold.

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5. The voltage regulated transistor driver of claim 1, wherein the multiplier control voltage indicates a selection of the voltage follower mode in response to the source voltage being greater than a high voltage threshold.

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6. The voltage regulated transistor driver of claim 1, wherein the multiplier control voltage indicates a selection of the voltage multiplier mode in response to the source voltage being less than a high voltage threshold and the regulated driver voltage being less than a low voltage threshold.

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7. The voltage regulated transistor driver of claim 1, wherein the multiplier control voltage indicates a selection of the voltage follower mode in response to the regulated driver voltage or the source voltage being greater than the high voltage threshold.

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8. The voltage regulated transistor driver of claim 1, wherein said voltage multiplier controller includes:

a voltage oscillator operable to generate and electrically communicate the multiplier control voltage to said variable voltage multiplier; and

an oscillation controller operable to electrically communicate an

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oscillation control voltage to said voltage oscillator, the oscillation control voltage for controlling at least one of a frequency and a duty cycle of the multiplier control voltage.

9. The voltage regulated transistor driver of claim 8,
wherein a fixed region of the voltage multiplier mode is defined by
the source voltage being less than a high voltage threshold and the regulated driver
voltage being less than a low voltage threshold; and
5 wherein, in the fixed region of the voltage multiplier mode, the
frequency and the duty cycle of the multiplier control voltage are fixed.

10. The voltage regulated transistor driver of claim 8,
10 wherein a varying region of the voltage multiplier mode is defined
by the source voltage being less than a high voltage threshold and the regulated driver
voltage being greater than a low voltage threshold; and
wherein, in the fixed region of the voltage multiplier mode, the
frequency and the duty cycle of the multiplier control voltage are varied.
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11. The voltage regulated transistor driver of claim 10, wherein the frequency
and the duty cycle of the multiplier control voltage are varied as function of the relative
magnitudes of the source voltage and the regulated driver voltage.
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12. The voltage regulated transistor driver of claim 8,
wherein, in the voltage follower mode, the frequency and the duty
cycle of the multiplier control voltage approach zero.

13. The voltage regulated transistor driver of claim 1, wherein said voltage multiplier controller includes:

a voltage oscillator operable to generate and electrically communicate the
5 multiplier control voltage to said variable voltage multiplier; and
an oscillation controller operable to electrically communicate an oscillation enable voltage to said voltage oscillator, the oscillation enable voltage for selectively enabling and disabling an oscillation of the multiplier control voltage by said voltage oscillator.

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14. The voltage regulated transistor driver of claim 13, wherein, in the voltage multiplier mode, an oscillation of the multiplier control voltage is enabled.

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15. The voltage regulated transistor driver of claim 13,
wherein, in the voltage follower mode, an oscillation of the multiplier control voltage is disabled.

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16. The voltage regulated transistor driver of claim 1,
wherein, in the voltage multiplier mode and in the voltage follower mode, said variable voltage multiplier includes means for generating the regulated driver voltage as a product of the source voltage and a factor X; and
wherein, in the voltage multiplier mode and in the voltage follower mode, said voltage multiplier controller includes means for controlling the factor X.

17. The voltage regulated transistor driver of claim 1,
wherein said variable voltage multiplier includes means for
generating the regulated driver voltage as a product of the source voltage and a factor X;
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wherein, in the voltage follower mode, said voltage multiplier
controller includes means for disabling said means for generating the regulated driver
voltage as a product of the source voltage and a factor X.

10 18. In a system employing a voltage source, a transistor driver, and at least one
transistor, a method of operating the transistor driver in regulating a drive voltage for
driving the at least one transistor, the method comprising:

receiving an electrical communication of a source voltage from the voltage
source; and

15 electrically communicating the regulated driver voltage to the at least one
transistor,

wherein, in a voltage multiplier mode, the regulated driver voltage
is greater than the source voltage, and

20 wherein, in a voltage follower mode, the regulated driver voltage
approaches the source voltage to thereby equal or approximate the source voltage.

19. The method of claim 18, further comprising:
operating in the voltage multiplier mode in response to the source voltage
being less than a high voltage threshold.

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20. The method of claim 19, further comprising:
operating in a fixed version of the voltage multiplier mode in response to
the regulated driver voltage being less than a low voltage threshold.

21. The method of claim 19, further comprising:
operating in a varying region of the voltage multiplier mode in response to
the regulated driver voltage being greater than a low voltage threshold.
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22. The method of claim 18, further comprising:
operating in the voltage follower mode in response to the source voltage
being greater than a high voltage threshold.
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23. The method of claim 18, further comprising:
operating in the voltage multiplier mode in response to the source voltage
being less than a high voltage threshold and the regulated driver voltage being less than a
low voltage threshold.
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24. The method of claim 18, further comprising:
operating in the voltage follower mode in response to at least one of the
regulated driver voltage and the source voltage being greater than the high voltage
threshold.
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25. A voltage regulated transistor driver employed in a system further
employing a voltage source and at least one transistor, said voltage regulated transistor
driver comprising:
means for receiving an electrical communication of a source voltage from
the voltage source; and
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means for electrically communicating the regulated driver voltage to the at
least one transistor,
wherein, in a voltage multiplier mode, the regulated driver voltage
is greater than the source voltage, and
wherein, in a voltage follower mode, the regulated driver voltage
approaches the source voltage to thereby equal or approximate the source voltage.
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